IN THE CLAIMS:

Please cancel claims 1, 11, 17, and 19-22, without prejudice.

1. Cancelled

2. (Currently Amended) ~~The method of automatically calibrating a water distribution model as defined in claim 1, including~~A method of automatically calibrating a water distribution model of a water distribution network, comprising the steps of: ~~performing a calibration evaluation including the steps of:~~

~~(A) computing a goodness-of-fit value for each calibration solution by using one or more of the following objective functions:~~

~~1.minimizing the sum of difference square;~~

~~2.minimizing the sum of absolute differences; and~~

~~3.minimizing maximum difference;~~

~~(B) defining the difference as the distance between field observed values and model simulated values including flows and pressure head/water levels; and~~

~~converting both flow differences and head level differences into an equivalent score using two conversion factors, including point per unit pressure head difference and point per unit flow difference; and(C) searching for optimized solutions using a genetic algorithm and calculating overall goodness of fit over the field data sets selected for a model calibration run, and assigning an overall goodness of fit to each solution as a fitness entry into a genetic algorithm to search for optimized solutions~~

(A) selecting calibration parameters including link status and one or more of , pipe roughness and junction demand;

(B) collecting field observed data including a pipe flow measurement and a junction pressure measurement for at least one point in the water distribution network, and in-

cluding corresponding loading conditions and boundary conditions that existed in the network when said field observed data was collected;

(C) generating a population of trial solutions that comprise a set of calibration results, using a genetic algorithm;

(D) running multiple hydraulic simulations of each trial solution to obtain a set of predictions of pipe flows and junction pressures at selected points in the network, corresponding to the different loading conditions and associated boundary conditions when the field observed data was collected;

(E) performing a calibration evaluation including ~~the steps of:~~

~~(A)~~ computing a goodness-of-fit value for each calibration solution ~~using one or more objective functions;~~

~~1. minimizing the sum of difference square;~~

~~2. minimizing the sum of absolute differences; and~~

~~3. minimizing maximum difference;~~

~~(F) selecting said function~~ based upon ~~the assigning the goodness-of-fit value for each solution as the fitness for that entry into a genetic algorithm; anddefining the~~ differences ~~as the distance~~ between field observed values and model simulated values including flows and pressure head/water levels; and

~~converting both flow differences and head level differences into an equivalent score using two conversion factors, including point per unit pressure head difference and point per unit flow difference; and~~

(F) ~~(C)~~ searching for optimized solutions using said a genetic algorithm and calculating ~~overall~~ goodness of fit over the field data sets selected for a model calibration run, and assigning ~~an overall~~ a goodness of fit to each solution ~~as a fitness entry~~ into a genetic algorithm to search for optimized solutions.

3. (Currently Amended) The method of automatically calibrating a water distribution model as defined in claim 2, including the further step of:

(A) selecting a weighting function for at least one of said field observed data measurements, said weighting function formulated as a ~~normalized~~ weighting factor of observed pressure heads and flows; and

(B) selecting as said weighting factor one of a linear, square, square root or log function of the ratio of individual value ~~(~~for flow or hydraulic pressure~~)~~ to a sum of the observed values ~~(~~of flows or hydraulic pressures~~)~~; and

(C) applying said weighting function when running said calibration evaluation to determine said goodness-of-fit value.

4. (Currently Amended) The method of automatically calibrating a water distribution model, as defined in claim ~~1~~ 2, including the further step of:

selecting as said loading condition, at least one water demand loading at a predetermined time of day, corresponding to a time of day when a field observed data measurement has been made.

5. (Original) The method of automatically calibrating a water distribution model, as defined in claim 4, including the further step of selecting multiple loading conditions representing demand loading at various times of day when field observed data measurements have been made.

6. (Currently Amended) The method of automatically calibrating a water distribution model as defined in claim ~~1~~ 2 wherein said boundary conditions include water storage tank levels, pressures control valve settings and pump operation speeds.

7. (Currently Amended) The method of automatically calibrating a water distribution model as defined in claim ~~1~~ 2 including the further step of:

after said optimized set of calibration data is obtained, making manual adjustments to this information for said water distribution model calibration.

8. (Currently Amended) The method of automatically calibrating a water distribution network model as defined in claim ~~1~~ 2, including the further step of performing a

sensitivity analysis by varying model input parameters over a predetermined range and observing the response thereto of said model.

9. (Original) The method of automatically calibrating a water distribution network model as defined in claim 8 including the further step of adjusting the collection of field observed samples based upon the results of said sensitivity analysis.

10. (Currently Amended) A computer readable medium containing executable program instructions for automatically calibrating a water distribution model of a water distribution network that has links that include pipes and junctions, the executable program instructions comprising program instructions for:

(A) generating a graphic user interface by which the user may enter data concerning field observed ~~measurements for the network~~data, demand alternatives and other information for the network~~and may make other entries and selections~~;

(B) a calibration module ~~formatted~~ configured to produces calibration information for a water distribution model constructed from user-selected calibration parameters that includes at least one of pipe roughness, junction demand information, ~~including demand groups,~~ roughness groups, and link status;

(C) a genetic algorithm module coupled to said calibration module and said user interface such that information about said calibration parameters, and user-entered field observed data, including ~~selected~~ field data~~-sets~~ that include calibration target data and boundary data, may be operated upon to produce a population of trial solutions, and said graphic user interface further being configured to allow a user to select goodness-of-fit criteria, a weighting function, and one or more genetic algorithm parameters and a number of top~~-trial~~ solutions that produce the least difference between the model simulated and field observed values; and

(D) a hydraulic network simulation module communicating with said genetic algorithm module such that top solutions generated by said genetic algorithm module can be run by said hydraulic network simulation module ~~and saved a to be used~~ to predict actual behavior of said network.

11. Cancelled.

12. (Currently Amended) The computer readable medium as defined in claim ~~11~~ 10, wherein said genetic algorithm module further includes optimization programming that repetitively computes successive generations of solutions based upon said fitness information calculated by said calibration module to at least one optimal solution, and multiple top solutions being saved ~~at the end of~~ for each optimized calibration run and ~~all~~ calibration settings and top solutions are ~~persisted~~ kept in such a manner that said user can review and retrieve ~~any~~ calibration run previously performed.

13. (Currently Amended) The computer readable medium as defined in claim 10 further comprising:
a database including information regarding water distribution networks for constructing models of said networks, and into which information can be saved.

14. (Previously Presented) The computer readable medium as defined in claim 10 wherein said user interface further allows a user to enter information regarding alternative demand loadings, representing a demand for water supply at a given point in time, at a given location in the network.

15. (Currently Amended) A method as described in claim ~~1~~ 2 wherein link status ~~includes the operational~~ is a status of being opened or closed of one or more of pipes,

valves and, as being on or off for pumps, in the water distribution model of the water distribution network that is being calibrated.

16. (Currently Amended) The method as defined in claim ~~1~~ 2 further comprising the step of:

computing a roughness value, roughness multiplier, ~~demand multiplier~~ and identifying link status.

17. Cancelled

18. (Currently Amended) The system as defined in claim 10 wherein a calibration run can be terminated to determine intermediate values, and can be paused and resumed ~~by selecting calibration stop criteria including maximum number of trials, minimum required goodness-of-fit, and maximum number of non-improvement generations of genetic algorithm optimization~~.

19. Cancelled

20. Cancelled.

21. Cancelled

22. Cancelled.